# SCIENCE LEARNING DESCRIPTION - SNAPSHOT

**INTRODUCTION**

Society is increasingly dependent on science and technology. Interesting and satisfying early experiences doing science help children construct understanding and develop intellectual habits that they will need in this society. Good instruction will focus on some of the big ideas or concepts of science, as well as on scientific skills or processes that help children investigate and solve problems both within and outside science. For example, 'patterns' is a big idea that could be used in the study of science topics as diverse as plants, rocks, and minerals. The concept of patterns could also be used as an organizer for non-science topics. Thus patterns and the other science core concepts have high potential as thematic topics.

Scientific skills such as observing, classifying, inferring, and measuring should be used in the study of all topics. Instruction should involve lots of hands-on experiences with a variety of materials. Students should frequently engage in interpretive discussions based on their direct experiences. Some discussions should occur in small groups during and following the hands-on experiences; the teacher should lead other interpretive discussions. Analyzing results and reporting on them must begin early in the primary program and change over time as abilities develop. At first, short oral statements and crude sketches may be the major mode of reporting. With experience, written words, better sketches, and more elaborate oral reports should be encouraged. With more experience, primary students should use graphs, more sophisticated or complex sketches, and written analyses in reporting.

In order to prepare children for their future in the rapidly developing global economy, daily investigative science instruction must be provided beginning in year one of the primary program. All teachers must participate and participation must be more than thirty minutes twice a week. A key to success is viewing investigative science as providing a meaningful experience base for oral communication, writing, reading, and using numbers.

**ABOUT THE SCIENCE LEARNING DESCRIPTION**

Several sources were influential in developing the Science Learning Description. Among them were the *Science Skills Continuum* (Kentucky Department of Education); *Science for All Americans* (American Association for the Advancement of Science); *Scope, Sequence, and Coordination* (National Science Teachers Association); *National Science Education Standards* (National Research Council); and *Transformations: Kentucky's Curriculum Framework* (Kentucky Department of Education).

**COMPONENTS OF THE LEARNING DESCRIPTION**

Kentucky's Academic Expectations, or core concepts, for science were used as organizers for the four components of the Science Learning Description: **Patterns and Nature of Scientific Activity**; **Systems, Interaction, and Nature of Scientific Activity**; **Models, Scale, and Nature of Scientific Activity**; **Change Over Time, Constancy, and Nature of Scientific Activity**. Note that while each component focuses on specific academic expectations, each group should not be viewed in isolation. Much overlap and integration should occur in primary classrooms.

Note that 'Nature of Scientific Activity' is part of all four components. All students need to learn the skills needed to conduct scientific investigations. Without using investigative skills it is impossible to garner objective evidence. Scientific skills, frequently called process skills, are the basis for conducting investigations in any field and must be introduced at the primary level. These skills begin with observing, classifying, communicating, measuring, gathering data, predicting, and inferring. Higher-level skills include identifying and controlling variables; communicating data with charts, graphs, and tables; and designing investigations.

**Patterns and Nature of Scientific Activity** - Regularly recurring similarities in objects or events constitute a pattern. Understanding patterns helps elementary-level students describe objects; understand relationships; and describe, interpret, and predict events and other phenomena in both natural and built environments.

**Systems, Interaction, and Nature of Scientific Activity** - Objects and events of all kinds acting and reacting with one another constitute interaction. A group of interacting objects or events forms a system. Evidence of interaction within and among systems is abundant in the world today. The study of systems and interactions helps children understand fundamental relationships useful in positively influencing their own and the global environment.

**Models, Scale, and Nature of Scientific Activity -** Many aspects of our environment are not readily understood or directly observable. Models are helpful in these cases, helping students understand how things look, work, or are related. Because the magnitudes of objects vary so greatly, the use of different scales helps us in constructing representations that facilitate communication and understanding.

**Change Over Time, Constancy, and Nature of Scientific Activity** - The idea of change over time enables students to understand that present conditions have evolved from preexisting conditions and will give rise to future conditions. Various entities, organizations, and systems evolve or change over time. These include entities as diverse as organisms, populations, political systems, societies, technological design, language, art, and music. Understanding the factors that influence change over time helps students make wise decisions that will lead, at least in part, to a determination of the future. Constancy refers to the self-regulation that occurs in many systems, resulting in consistency or steady states.

## USING THE LEARNING DESCRIPTION

A sample of key ideas from the four components are presented on the first continuum, labeled 'Snapshot.' While the local school district has considerable discretion in selecting content to develop the performance abilities and accomplishments identified in the components, it is expected that content from the life, earth, and physical sciences will be selected. For example, an expectation in the Systems, Interaction, and Nature of Scientific Activity section is that students 'Identify' and describe relationships among interacting objects.? They could do this while studying crickets in a terrarium, the effects of weathering, or the relative strengths of two different magnets. The reader can likely think of dozens of other life, earth, and physical science contexts that would work as well or better. Thus, the performance abilities and accomplishments identified in the four components and Snapshot are examples that should be addressed over a period of years in the primary program using a variety of content topics and problems. These are examples - hopefully very good examples - but the list is not comprehensive

# SCIENCE LEARNING DESCRIPTION - SNAPSHOT

***SNAPSHOT*** - This section provides a quick overview of the four science components. It gives a general description or a starting point to help you identify the characteristics a student is exhibiting while becoming a scientist. Few students will exhibit characteristics all at the same point on the continuum. The detailed narrative explanations on pages 4-11 will give you more specific information about students' science development, often with examples.

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| | | | | | **INDICATES SUCCESSFUL COMPLETION OF PRIMARY** |
| **BEGINNING** | | **DEVELOPING** | | **COMPETENT** | |
| Uses the senses to identify patterns. | Identifies and describes simple patterns and changes; makes a simple representation of a pattern. | Extends a pattern; identifies non-examples of patterns. | Keeps a pictorial or written record of changes in patterns. | Demonstrates relationships among patterns by comparing and contrasting; records observations. | Makes predictions based on patterns in science phenomena. |
| Describes objects by their properties. | Classifies objects based on properties or materials. | Describes evidence of interaction in a variety of situations. | Describes relationships among interacting objects. | Plans and constructs a system to serve a particular function. | Describes relationships between structure and function in a system. |
| Identifies and represents common objects with sketches, 3-dimensional constructions, and role-playing. | Compares sketches, 3-dimensional constructions, and photographs with the actual objects or systems, and role-plays to observe the relationships between models and what they represent. | Observes and constructs representations of a variety of living and non-living objects. | Communicates a conceptual understanding of ?model? in working with representations of objects or events. | Communicates a conceptual understanding of ?scale? and its importance in relation to various models. | Draws conclusions and/or makes predictions based on scale models. |
| Describes observations of similarities and differences. | Describes a sequence of events. | Investigates changes that occur during a year. | Investigates conditions that promote or inhibit change over time. | Investigates and describes occurrences in the environment that illustrate change over time. | Makes predictions of changes based on recurring patterns of changes in the environment. |
| Analyzes and reports orally. | | Analyzes and reports orally, adding sketches and written words. | | Analyzes and reports orally, adding written words, short sentences, single sketches, charts, graphs. | |

# SCIENCE LEARNING DESCRIPTION - SNAPSHOT

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| | | | | | **INDICATES SUCCESSFUL COMPLETION OF FIFTH GRADE** |
| **EXPANDING** | | | | | **ACCOMPLISHED** |
| Uses patterns to interpret past and present events and predicts future changes based on past events.<br>Uses a variety of data sources in studying a system and reporting findings. | Observes and describes a pattern that is influenced by the effects of more than one variable. | Measures and records a change caused by variables that affect the pattern of an event. | Identifies a pattern of events (cycles) within a system. Explains how a change in one variable could alter the system. | Infers cause and effect relationships from patterns of change. | Identifies patterns in physical or living systems and makes predictions and/or solves problems based on the patterns observed. |
| Uses models to analyze or solve both science and non-science problems. | Describes interactions in a classroom system.<br>Observes and communicates attributes of an object/event/ system from various perspectives. | Identifies subsystems and predicts how an alteration of a subsystem would influence the system. | Describes the transfer of energy in a variety of life, earth, and physical science systems including motion, light, electrical, and heat energy.<br>Uses a variety of data sources and technology to identify and investigate regulatory systems in living organisms that allow the organism to survive. | Investigates and describes systems that work together in an effort to achieve constancy.<br>Manipulates variables in a model to predict results in the real object, event, or system. | Demonstrates understanding of relationships between a community of organisms and environmental factors. |
| Constructs a time line based on changes in an ecological system. | Collects and interprets data related to the processes affecting the earth's surface. | Formulates a model of something that cannot be seen. | Plans, constructs, and then evaluates a model of a 3-dimensional object or system using a scale that reveals relationships between the structure and function of the object or system. | Interprets graphs and other data to identify changes as steady, repetitive, or irregular. | Formulates models to illustrate, explain, or predict phenomena. |
| Describes how the self-regulating components of a system maintain constancy. | Investigates and interprets data related to the constancy of natural phenomena. | Describes changes in size, weight, color, and movement by taking accurate measurements. | Distinguishes between patterns of regularly recurring change and patterns of change that are easily influenced by external factors. | Relates structure and function in a variety of life, earth, and physical science contexts, including products used by humans. | Identifies and contrasts the consequences of environmental changes occurring in small increments over a long time and those that occur in large increments over a short time. |
| Analyzes and reports orally and with sketches and graphs.<br>Uses short paragraphs when reporting in writing. | | Better coordinates oral and written components of reports.<br>Shows improvement in clarity and thoroughness. | | Shows ability to coordinate a variety of media in reporting.<br>Shows increasing clarity and thoroughness. | |

# SCIENCE LEARNING DESCRIPTION - PATTERNS AND NATURE OF SCIENTIFIC ACTIVITY

***PATTERNS AND NATURE OF SCIENTIFIC ACTIVITY*** - Regularly recurring similarities in objects or events constitute a pattern. Understanding patterns helps elementary-level students describe objects; understand relationships; and describe, interpret, and predict events and other phenomena in both natural and built environments.

**INDICATES SUCCESSFUL COMPLETION OF PRIMARY**

| **BEGINNING** | | **DEVELOPING** | | **COMPETENT** | |
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| The young scientist uses senses to observe and then discuss patterns in various situations, e.g., weather, living organisms.<br><br>Sorts objects into sets based on a specific property (e.g., shells, keys, buttons), then names or describes the sets.<br><br>States order of events and/or objects, e.g., longest to shortest, first to last.<br><br>Describes objects and events. | The young scientist identifies and communicates similarities and/or differences among items in a group.<br><br>Identifies and describes simple patterns and changes, e.g., day/night, poetry, predictable/ pattern books.<br><br>Makes simple representations of patterns, e.g., drawings, leaf prints, stringing beads of different colors and shapes.<br><br>Identifies and extends constructed patterns, e.g., counting and clapping patterns.<br><br>Labels sets of objects appropriately. | The young scientist classifies objects using one or more than one property or attribute (e.g., putting leaves into groups) and shows results with a sketch and explanation.<br><br>Creates and extends patterns.<br><br>Uses measurement units (e.g., paper clips, unifix cubes, rulers) for record keeping.<br><br>Identifies examples of non-patterns, e.g., random arrangements of objects. | The young scientist classifies objects according to properties and attributes and uses sub-groups, e.g., Venn diagram.<br><br>Identifies real-life patterns in the observable environment, e.g., leaves, clothing, life cycle of insects.<br><br>Keeps a record (pictorial and/or written) of changes in patterns or changes that follow a pattern, e.g., weather, length of lunch line. Analyzes data and prepares an interpretive report.<br><br>Studies the growth and development patterns of people and other organisms. | The young scientist identifies and describes patterns involving objects or events in a variety of earth and physical science contexts; reports of results include sketches.<br><br>Identifies relationships and/or patterns involving numbers.<br><br>Sets-up terrariums and/or aquaria; records and graphically represents data collected from a variety of life science investigations and provides interpretations. | The young scientist makes predictions based on patterns in science-related phenomena, e.g., water cycle, length of shadows, day/night, and changes in populations.<br><br>Creates patterns using a variety of materials and records and reports results.<br><br>Identifies factors (e.g., light, heat, moisture) that consistently influence changes in materials or populations.<br><br>Uses standard units of measurement (e.g., meters, inches, degrees Celsius, liters) during science related investigations to help evaluate results. |
| Analyzes and reports orally. | | Analyzes and reports orally, adding sketches and written words. | | Analyzes and reports orally, adding written words, short sentences, single sketches, charts, graphs. | |

# SCIENCE LEARNING DESCRIPTION - PATTERNS AND NATURE OF SCIENTIFIC ACTIVITY

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| | | | | | **INDICATES SUCCESSFUL COMPLETION OF FIFTH GRADE** |
| **EXPANDING** | | | | | **ACCOMPLISHED** |
| The scientist predicts variables (e.g., energy chains, motion, growth) that will influence change in patterns.<br><br>Supports ideas with evidence that reveals a pattern.<br><br>Interprets past and present events and predicts future changes based on past events.<br><br>Observes and describes patterns in life cycles. | The scientist identifies and changes a variable (e.g., amount of ice added to water, number of wraps of a rubber band to turn a propeller) that affects a pattern or an event.<br><br>Observes and describes a pattern that is influenced by more than one variable, e.g. weather, migration, electromagnetism: number of wire wraps and number of batteries.<br><br>Observes and records patterns of interaction between substances to classify the type of change, e.g., vinegar and baking soda as an example of chemical change, baking soda and water as an example of physical change.<br><br>Investigates and reports data on patterns related to human activity.<br><br>Identifies patterns of interaction among living things in food chains and webs, including decreasing numbers of organisms in a food pyramid. | The scientist measures and records a change that affects the pattern of an event, e.g., temperature on plant growth, heat on the solubility of a substance.<br><br>Classifies events based upon patterns of change, e.g., erosion, weathering, succession, carrying capacity. Determines beneficial and detrimental aspects of those events.<br><br>Collects data and charts or graphs patterns of changes in living organisms, e.g., birth rate, death rate, germination rate.<br><br>Collects data and graphs or charts patterns of motion, e.g., pendula, shadows on the playground, rolling spheres.<br><br>Identifies patterns of structure and function in nature and compares them to structure and functions in products created by people.<br><br>Identifies geometrical patterns as the same in slides, rotations, and reflections. | The scientist identifies a pattern of events (cycles) within a system. Explains how a change in one variable could alter the system, e.g., effects of a pollutant on an aquatic system.<br><br>Investigates correlated pattern changes, e.g., day/night and outdoor temperature, heartbeat rate and physical activity.<br><br>Investigates and records behavior patterns of organisms and relates them to environmental factors, food supply, competition with other organisms.<br><br>Analyzes a variety of data representations (e.g., graphs and charts) to determine patterns of change and to predict future trends. | The scientist predicts how a change in one variable will affect the pattern in a system, e.g., vary the size of gears in a gear system, varying environmental factors and plant growth, variations in a pulley system.<br><br>Identifies two related patterns and describes the relationship, e.g., apparent movement of the sun and the length of a shadow, direction of water ripples to wind direction, spring season and animal reproduction.<br><br>Infers cause and effect relationships from patterns of change, e.g., amount of moisture to rate of rust, increased heat on evaporation rate.<br><br>Identifies symmetry in living things and creates symmetrical patterns. | The scientist changes a variable to solve a problem. Uses evidence to explain how the problem was solved.<br><br>Identifies relationships among patterns of events, e.g., the relationship of pitch produced by a column of air and the sound of a plucked thick rubber band, seasonal change and plant/animal responses, movement of constellations over a year?s revolution of the earth.<br><br>Identifies patterns in physical or living systems and makes predictions and/or solves problems using the patterns.<br><br>Identifies, describes, and constructs models showing repeating developmental, behavioral, symmetrical, or cyclical patterns of events or objects. |
| Analyzes and reports orally and with sketches and graphs.<br>Uses short paragraphs when reporting in writing. | | Better coordinates oral and written components of reports.<br>Shows improvement in clarity and thoroughness | | Shows ability to coordinate a variety of media in reporting.<br>Shows increasing clarity and thoroughness. | |

***SYSTEMS, INTERACTIONS, AND NATURE OF SCIENTIFIC ACTIVITY*** - Objects and events of all kinds acting and reacting with one another constitute interaction. A group of interacting objects or events forms a

# SCIENCE LEARNING DESCRIPTION - PATTERNS AND NATURE OF SCIENTIFIC ACTIVITY

system. Evidence of interaction within and between systems is abundant in the world today. The study of systems and interactions can help individuals understand fundamental relationships useful in positively influencing their own and the global environment.

**INDICATES SUCCESSFUL COMPLETION OF PRIMARY**

| **BEGINNING** | | **DEVELOPING** | | **COMPETENT** | |
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| The young scientist identifies objects that influence or affect other objects.<br><br>Describes objects by their properties.<br><br>Describes objects by materials, e.g., plastic, wood, metal, rubber, glass.<br><br>Describes changes occurring over time, e.g., growth of a child, seeds germinating. | The young scientist describes and observes interactions, e.g., weathering, plants growing.<br><br>Classifies objects (e.g., rocks, buttons, seeds) based on one property, e.g., color, shape, size, texture.<br><br>Classifies objects based on materials.<br><br>Investigates a variety of life, earth, and physical phenomena. Uses sketches in reports. | The young scientist describes evidence of interaction using words and/or sketches, e.g., ice melting, bread molding.<br><br>Classifies objects (e.g., rocks, buttons, seeds) based on more than one property.<br><br>Identifies parts of organisms or non-living objects.<br><br>Investigates a variety of living and non-living interacting objects, and prepares and presents a report on the interactions. | The young scientist uses the interaction concept in describing changes in physical, biological, and earth science systems, e.g., electrical, earth/moon, ecosystem, body.<br><br>Identifies and describes relationships among interacting objects.<br><br>Identifies the function(s) of a variety of systems (e.g., mechanical, electrical, chemical) and prepares and presents reports on them.<br><br>Identifies the major variables affecting a particular system and uses sketches in reports. | The young scientist uses the interaction concept in identifying a pattern in a system, e.g., effects of seasons on organisms, water cycle.<br><br>Classifies systems based on properties or functions (e.g., electrical system, transportation system) and describes the results.<br><br>Plans and constructs a system to serve a particular function (e.g., a terrarium to serve particular organisms or a model to show the water cycle) and reports with sketches and writing. | The young scientist collaborates with others to use the concept of interaction while constructing and interpreting a model of some physical, biological, or earth science system, and reports the results.<br><br>Describes the relationship between structure and function in a living or non-living system, e.g., simple machine, human body system, aquarium.<br><br>Describes the impact of some external factors on science-related systems, e.g., water added to terrarium, amount of weight added to a parachute. |
| Analyzes and reports orally. | | Analyzes and reports orally, adding sketches and written words. | | Analyzes and reports orally, adding written words, short sentences, single sketches, charts, graphs. | |

# SCIENCE LEARNING DESCRIPTION - PATTERNS AND NATURE OF SCIENTIFIC ACTIVITY

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| | | | | | **INDICATES SUCCESSFUL COMPLETION OF FIFTH GRADE** |
| **EXPANDING** | | | | | **ACCOMPLISHED** |
| The scientist predicts interactions in a variety of life, earth, and physical systems over time.<br><br>Predicts the impact of external factors on a variety of life, earth, and physical systems.<br><br>Collaborates to design and conduct experiments that involve collecting, organizing, and interpreting data and reporting results.<br><br>Uses a variety of data sources to study a system and report findings. | The scientist describes interactions in a system displayed in the classroom (e.g., a system that shows evaporation, condensation, and precipitation of water) and relates the interactions to those observed in a naturally occurring system.<br><br>Uses interactions observed in a living system to infer interdependencies and predict the effects of a dramatic change in one of the populations.<br><br>Investigates the effects of a single variable, e.g., light, on plants and animals.<br><br>Describes different soil types and relationships among soil types, plant growth, and water movement. | The scientist uses knowledge of magnetic interactions to predict outcomes.<br><br>Uses knowledge of concepts of electricity (e.g., circuits and conductors) in constructing functional electrical systems.<br><br>Obtains data to describe recurring patterns in earth/moon and earth/sun systems, e.g., day/night, phases of the moon, seasons, eclipses.<br><br>Constructs displays or models to show soil formation and weathering.<br><br>Identifies subsystems and predicts how an alteration of a subsystem would influence the system. | The scientist identifies the variables that influence movements (e.g., locomotion and migration) of living organisms, e.g., isopods and people.<br><br>Describes the transfer of energy in a variety of life, earth, and physical science systems including motion, light, electrical, and heat energy.<br><br>Demonstrates an understanding of relationships among populations of organisms in a community.<br><br>Uses innovative methods to report on contributions of persons representing different races and gender in a scientific or technical advancement. | The scientist describes the movement or transfer of energy in a variety of life, earth, and physical science systems, including food chains, streams, and rolling spheres.<br><br>Shows the ability to alter a system (e.g., paper gliders, marble roller) to influence in predictable ways the speed and/or distance an object travels.<br><br>Designs and conducts investigations of how a single variable (e.g., light) influences humans and other living organisms, e.g., plant growth, marketing clothing.<br><br>Is able to relate structure and function in a variety of life, earth, and physical science contexts, including products used by humans, e.g., relates a screwdriver's shape to its purpose. | The scientist demonstrates understanding of relationships between a community of organisms and environmental factors.<br><br>Uses a multi-media approach to show relationships within and among life, earth, and physical science systems.<br><br>Uses an innovative approach to show how science and technology can be used to address an important social problem.<br><br>Contributes to a group design of an experiment to investigate a problem. |
| Analyzes and reports orally and with sketches and graphs.<br>Uses short paragraphs when reporting in writing. | | Better coordinates oral and written components of reports.<br>Shows improvement in clarity and thoroughness. | | Shows ability to coordinate a variety of media in reporting.<br>Shows increasing clarity and thoroughness. | |

# SCIENCE LEARNING DESCRIPTION – MODELS, SCALES, AND NATURE OF SCIENTIFIC ACTIVITY

***MODELS, SCALE, AND NATURE OF SCIENTIFIC ACTIVITY*** - Many aspects of our environment are not readily understood or directly observable. In these cases, models help us understand how things look, work, or are related. Because the magnitudes of objects vary so greatly, the use of different scales helps us construct representations that facilitate communication and understanding

**INDICATES SUCCESSFUL COMPLETION OF PRIMARY**

| **BEGINNING** | | **DEVELOPING** | | **COMPETENT** | |
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| The young scientist represents real objects with sketches and 3-dimensional constructions, and represents events with role-play, e.g., a clay model of an animal moving like an animal moves.<br><br>Describes representations of real objects as smaller, same, or larger than the objects.<br><br>Identifies common objects from sketches and 3-dimensional constructions, and identifies events from role-playing. | The young scientist uses a sketch, photograph, or role-play to draw conclusions about the structure and function of real objects or events, and includes living and other changing objects.<br><br>Infers whether a representation of some real object is smaller than, same as, or larger than the actual object, e.g., toy car vs. automobile, globe vs. the earth.<br><br>Identifies differences between representations of objects or models and the actual objects. | The young scientist represents an object or science-related event (e.g., water cycle, mining process) with a model, e.g., a sketch, 3-dimensional construction, role-play.<br><br>Infers whether a representation is complete or only part of the actual event or object, e.g., snow melting as part of water cycle, model of eye as part of human body, globe as complete model of the earth.<br><br>Transfers sketches from one size paper to another, shrinking or enlarging size, e.g., making a sketch of an insect larger to reveal its parts. | The young scientist uses sketches, photos, 3-dimensional constructions, and/or diagrams to draw conclusions about science investigations and relationships, e.g., water cycle, life cycle.<br><br>Communicates an understanding that sketches, photos, 3-dimensional constructions, diagrams, and role-plays are 'models' or representations.<br><br>Analyzes a representation done on two sizes of grid paper for general proportional consistency.<br><br>Uses models in non-science contexts, e.g., family tree, sketches showing bike paths or bus routes. | The young scientist represents a science system (e.g., sound maker, prism, aquarium) with a diagram, 3-dimensional construction, or role-play.<br><br>Identifies sub-systems shown by a model, e.g., water cycle in biosphere, battery in electrical device, heart in the circulatory system.<br><br>Infers why it is helpful, or even necessary, to represent the actual size of some objects differently with science models.<br><br>Identifies proportional representations of an object or system done in different sizes as being 'scaled' representations, e.g., those that keep relative size and other relationships consistent.<br><br>Uses globes and other models in studying earth relationships. | The young scientist uses models (e.g., diagrams, 3-dimensional constructions, photos, and role-plays) to draw conclusions about systems used in science investigations.<br><br>Obtains and uses data on biological, earth, and physical systems to construct models.<br><br>Identifies discrepancies between the representations (models) of a system and the actual system.<br><br>Demonstrates understanding that models may represent things that can be seen, cannot be seen, or cannot be seen easily or in their entirety.<br><br>Individually or as part of a group, constructs a scale map of some observable area in or around the school or home, e.g., desk in school, classroom, bedroom, school campus. |
| Analyzes and reports orally. | | Analyzes and reports orally, adding sketches and written words. | | Analyzes and reports orally, adding written words, short sentences, single sketches, charts, graphs. | |

# SCIENCE LEARNING DESCRIPTION – MODELS, SCALES, AND NATURE OF SCIENTIFIC ACTIVITY

**INDICATES SUCCESSFUL COMPLETION OF FIFTH GRADE**

| **EXPANDING** | | | | | **ACCOMPLISHED** |
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| The scientist analyzes strengths and weaknesses of structure and function relationship of a model object, event, or system, e.g., test bridges made of Legos® for strength.<br><br>Uses models to analyze or solve both science and non-science problems.<br><br>Identifies limitations of specific models.<br><br>Uses scale to construct a sketch or diagram from a smaller or larger sketch or diagram.<br><br>Uses height of a known object in pictorial data to estimate heights of other objects shown.<br><br>Interprets and communicates information contained in histograms, bar graphs, and line graphs. | The scientist uses imagery or metaphors to communicate understanding of an object, event, or system not easily observed, e.g., a beehive, working of a watch, infrastructure of a building.<br><br>Observes and communicates attributes of an object, event, or system from various perspectives, e.g., plant growth above and below the soil, top and bottom of an object, left/right sides of an object.<br><br>Given the dimensions of an object, can establish a scale and consistently construct the object in the correct proportions (using grid paper).<br><br>Uses histograms, bar graphs, and line graphs to organize and study data for a variety of investigations in the life, earth, and physical sciences. | The scientist uses manipulatives (unifix, multi-link blocks, play dough, etc.) to investigate changes that occur when the size factor is changed, e.g., changes in mass and volume of a cube when the length of one edge is doubled.<br><br>Formulates a model of something that cannot be seen, e.g., sound waves, and germs spreading.<br><br>Is aware that analogies can communicate relationships between the structure and function of an object, event, or system.<br><br>Constructs and interprets accurate and appropriate circle, bar, and line graphs. | The scientist uses scale in comparing a model to an actual system or event, e.g., blueprint of a building compared to the actual building, scale map of city streets compared to actual street layout or size.<br><br>Identifies limitations of observing an object, event, or system from a single perspective, e.g., flat earth, animal coloration/ camouflage, and human behavior.<br><br>Analyzes models for accuracy in terms of proportional relationships.<br><br>Plans, constructs, and then evaluates a model of a 3-dimensional object or system using a scale that reveals relationships between the structure and function of the object or system, e.g., building a bridge from marshmallows and straws, reducing the scale by using mini-marshmallows and toothpicks, then comparing the structure of the two. | The scientist manipulates variables in a model to predict results in the real object, event, or system, e.g., changing the forces acting on an object, such as a scale model of a bridge, movement of a small vehicle.<br><br>Presents data using a multi-media format, e.g. combines text, sound, and graphics in a computer-generated report.<br><br>Uses analogies to describe and communicate relationships between structure and function of an object, event, or system. | The scientist uses a model to investigate relationships, e.g., carrying capacity of land resources for a particular plant or animal.<br><br>Formulates models to illustrate, explain, or predict phenomena, e.g., electrical circuits, and movement of light or sound through different materials.<br><br>In collecting and analyzing data, describes the significance of perspective, e.g., position from which an observation is made, proximity to the object, event, or system being investigated.<br><br>Explores limits on how big or small an object, event, or system can be and still retain proportional and/or functional characteristics, e.g., body structure of some amphibians, aircraft, ships. |
| Analyzes and reports orally and with sketches and graphs.<br>Uses short paragraphs when reporting in writing. | | Better coordinates oral and written components of reports.<br>Shows improvement in clarity and thoroughness. | | Shows ability to coordinate a variety of media in reporting.<br>Shows increasing clarity and thoroughness. | |

# SCIENCE LEARNING DESCRIPTION - CHANGE OVER TIME, CONSTANCY, AND NATURE OF SCIENTIFIC ACTIVITY

***CHANGE OVER TIME, CONSTANCY, AND NATURE OF SCIENTIFIC ACTIVITY*** - The idea of change over time enables us to understand that present conditions have evolved from preexisting conditions and will give rise to future conditions. Various entities, organizations, and systems evolve or change over time. These include entities as diverse as organisms, populations, political systems, societies, technological design, language, art, and music. By understanding the factors that influence change over time, it is possible to make wise decisions that will lead, at least in part, to a determination of the future. Constancy refers to the self-regulation that occurs in many systems, resulting in consistency or steady states.

**INDICATES SUCCESSFUL COMPLETION OF PRIMARY**

| **BEGINNING** | | **DEVELOPING** | | **COMPETENT** | |
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| The young scientist observes and describes objects, including organisms, and identifies them as living or non-living.<br><br>Classifies objects based on properties.<br><br>Observes parents and offspring and concludes that 'like produces like.'<br><br>Classifies organisms based on characteristics, e.g., body coverings, means of locomotion.<br><br>Describes changes in weather.<br><br>Describes changes in the community. | The young scientist identifies and describes variations in living organisms.<br><br>Describes changes in going from night to day.<br><br>Develops sequences (time lines) of a few pictures or other data that represent changes over time, e.g., growth and development from infancy to present age.<br><br>Describes a series of events in sequence, e.g., sprouting of a seed, growth of roots, stem, and leaves.<br><br>Describes changes over time, e.g., ice melting, egg cooking, popcorn popping, seasonal changes. | The young scientist identifies and describes variations among animals of the same species, e.g., color, size, length of coat.<br><br>Shows change over time with sequence of pictures or sketches.<br><br>Investigates changes in weight, height, and ability to do specific tasks over the span of the school year.<br><br>Identifies and describes the 'wearing out' of objects.<br><br>Observes and records change over time due to seasonal changes, e.g., changes in a deciduous tree, changes in animal populations.<br><br>Classifies rocks based on properties and places the rocks in serial order based on these properties. | The young scientist observes and represents (with a model) life cycles of plants and animals, e.g., seed to plant, tadpole to frog.<br><br>Classifies rocks on the basis of how they were formed, e.g., igneous, metamorphic, and sedimentary.<br><br>Measures and charts changes, e.g., size in plants or animals as they mature.<br><br>Investigates conditions that promote or inhibit change, e.g., bread molding, water evaporating.<br><br>Observes and describes changes in states of matter, e.g., ice to water, liquid to solid as in gelatin. | The young scientist describes adaptations of organisms that help them survive in their environments.<br><br>Identifies and describes evidence of organisms that no longer exist (fossil evidence).<br><br>Investigates and describes occurrences in the environment that illustrate change, e.g., erosion, earthquakes.<br><br>Infers the life habits of an organism based on fossils and other evidence.<br><br>Graphs changes in the size of a population in a changing environment, e.g., population of deer in a recently inhabited area.<br><br>Reports evidence of aging processes for a variety of structures, e.g., human body, buildings, soap bubbles, rocks, and trees. | The young scientist investigates adaptations that enable animals and plants to survive, e.g., movements, body coverings, and method of reproduction.<br><br>Investigates change in communities, e.g., size, age of homes, ethnic composition. Uses surveys and databases, and prepares illustrated reports.<br><br>Identifies natural recurring patterns of change in the environment and variables that can alter them, e.g., drastic changes in weather patterns, intrusion of humans, design of new structures.<br><br>Reports on investigations over time, e.g., of ice cubes melting, weather, and decomposition of foods. |
| Analyzes and reports orally. | | Analyzes and reports orally, adding sketches and written words. | | Analyzes and reports orally, adding written words, short sentences, single sketches, charts, graphs. | |

# SCIENCE LEARNING DESCRIPTION - CHANGE OVER TIME, CONSTANCY, AND NATURE OF SCIENTIFIC ACTIVITY

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| | | | | | **INDICATES SUCCESSFUL COMPLETION OF FIFTH GRADE** |
| **EXPANDING** | | | | | **ACCOMPLISHED** |
| The scientist designs experiments to investigate environmental conditions in some living systems.<br><br>Constructs a time line based on changes in an ecological system, e.g., reforestation.<br><br>Classifies human-made change to the environment (e.g., landfills, acid rain, new products) as positive or negative and predicts future impact.<br><br>Investigates effects of seasonal changes on living organisms.<br><br>Describes how the self-regulating components of a system maintain constancy, e.g., thermostat in a home, body systems, and traffic lights to control traffic flow. | The scientist investigates the composition of soil and describes the change processes that result in soil formation, including weathering of rock and decomposition of organic matter.<br><br>Identifies changes (e.g., climatic changes or migration) that alter the ecosystem.<br><br>Collects and interprets data related to the processes affecting the earth's surface, e.g., erosion, weathering.<br><br>Investigates and interprets data related to the constancy of natural phenomena, e.g., rotation of the earth or changes in the night sky. | The scientist investigates and describes changes that impact the earth's surface, e.g., the 'rock cycle.'<br><br>Investigates beneficial and harmful changes in an organism's habitat.<br><br>Describes changes in size, weight, color, and movement by taking and using accurate measurements.<br><br>Collects and interprets data related to seasonal change, e.g., temperature, daylight hours.<br><br>Uses a variety of data sources and technology to identify and investigate regulatory systems in living organisms that promote organisms? survival. | The scientist describes rock strata and other geologic features in studying the age and/or development of the earth.<br><br>Investigates and describes both deliberate and inadvertent ways that human activities have changed an ecosystem.<br><br>Investigates and describes changes that occur in natural cycles, e.g., the seasons or life cycles.<br><br>Distinguishes between patterns of regularly recurring change (e.g., the revolution of the moon around the earth) and patterns of change that are easily influenced by external factors, e.g., plant growth. | The scientist identifies and investigates human activities that have changed the capacity of the environment to support life.<br><br>Interprets graphs and other data to identify changes as steady, repetitive, or irregular.<br><br>Infers environmental changes that have occurred over time by examining fossils, geological features, and artifacts.<br><br>Describes systems and investigates the relationship of the systems in working toward achieving constancy, e.g., the systems that make up the human body. | The scientist uses technology in preparing a multi-media report on how human-made systems (e.g., communication, transportation, monetary) have changed over time.<br><br>Contrasts the consequences of environmental changes occurring in small increments over a long time (e.g., weathering or changes in species), and those that occur in large increments over a short time, e.g., earthquakes or volcanic eruptions.<br><br>Develops a scenario likely to result in extinction of a species: shows environmental changes and adaptive characteristics of the organism that would prevent it from competing successfully.<br><br>Investigates and reports on ways modern technology has influenced how humans and wild animals have adapted to their environments. |
| Analyzes and reports orally and with sketches and graphs.<br>Uses short paragraphs when reporting in writing. | | Better coordinates oral and written components of reports.<br>Shows improvement in clarity and thoroughness. | | Shows ability to coordinate a variety of media in reporting.<br>Shows increasing clarity and thoroughness. | |